DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/20/2008 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 8 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. As to claim 8, Applicants, in invention's disclosure, fail to disclose how the maximum-likelihood criterion is determined from the Euclidian distance between the received signal, the scatterer coefficients and the signal data demodulated in the receiver, in a way to enable one skilled in the art to use the same method.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 3, are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. ("Generation of scattering functions by computer simulation for mobile communication channels", Vehicular Technology Conference, 1996. 'Mobile Technology for the Human Race'., IEEE 46th; Publication Date: 28 Apr-1 May 1996, Volume: 3, On page(s): 1443-1447 vol.3.), and Wiedeman et al. (hereafter, referred as Wiedeman) (US 5,796,760), further in view of Chabah et al. (hereafter, referred as Chabah) (US 6,310,575).

As to claim 1, Wang discloses a data signal transmitted via a time-variant channel to a receiver (see page 1443), wherein scatter coefficients including attenuation (see page 1444, left column), delay and Doppler frequency (see page 1444, right column) in the received data signal, which cause signal distortion in the channel, are measured in the receiver (see pages 1443 and 1444). Although Wang does not disclose that the signal is transmitted using a single-carrier or multi-carrier, in order to transmit the signals from transmitter to the receiver, inherently, there must be at least one carrier (single carrier). Wang discloses all the subject matters claimed in claim 1, except that the data signal is equalized with the scatterer coefficients and then demodulated with them. Wang also does not disclose that the scatterer coefficients are measured via a

maximum likelihood criterion. As to the first limitation, Wiedeman discloses a receiver apparatus comprising an equalizer and a demodulator, wherein the equalizer equalizes a Doppler frequency offset (interpreted as the first scatterer coefficient) for each correlated signal and the delay (interpreted as the second scatterer coefficient) of each of the correlated signals (see column 15, last paragraph). Wiedeman further discloses that the receiver includes circuitry for combining together all equalized correlated signals to provide a demodulator with a composite received signal (see column 15, last paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang as suggested by Wiedeman in order to transmit the majority of the signal over the communication path (or paths) which are capable of conveying a highest quality signal (see column 16, first paragraph) and as the result increase the performance of the receiver. Wang and Wiedeman disclose all the subject matters claimed in claim 1, except that the scatterer coefficients are measured via a maximum likelihood criterion. Chabah discloses a method for estimating Doppler frequency (see column 4, lines 37-43). Chabah further discloses that the Doppler frequency (interpreted as Scatterer coefficients) is estimated for each candidate according to the known criterion of generalized maximum likelihood. It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang and Wiedeman as suggested by Chabah to provide a fast and accurate estimation for Doppler frequency.

As to claim 3, Wang does not expressly disclose that the measurements have been taken place in the context of single-carrier data transmission schemes. However,

in order to transmit the signals from transmitter to the receiver, inherently, there must be at least one carrier (single carrier).

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, and Chabah further in view of Borowski (US 3,997,841).

As to claim 2, Wang discloses that the measurement of the scatterer coefficients has been taken place in the time domain (see the abstract and page 1443, right column). Wang, Wiedeman, and Chabah disclose all the subject matters claimed in claim 2, except that the equalization of the data signal takes place within the time domain. Borowski discloses that the advantages of the time-domain equalizers are that sufficient noise suppression can be achieved, which permits the use of a low-noise amplifier with sufficient control range (see column 1, paragraph 4). Therefore, for the reasons stated above, it would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, and Chabah to use a time domain equalizer to equalize the data signal.

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, and Chabah further in view of Schenk et al. (hereafter, referred as Schenk) (US 6,647,076).

As to claim 5, Wang discloses that the measurement of the scatterer coefficients has been taken place in the frequency domain (see the abstract and page 1443, right column). Wang, Wiedeman, and Chabah disclose all the subject matters claimed in claim 5, except that the equalization of the data signal takes place within the frequency domain. Schenk discloses that a frequency domain equalizer is used for the channel

equalization of a signal vector (see column 5, lines 35-40). Schenk further discloses that the frequency domain equalizers require a smaller outlay on circuitry than time domain equalizers and can be implemented as a simple and fast algorithm and as a simple circuit (see column 2). Therefore, for the reasons stated above, it would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, and Chabah to use a frequency domain equalizer to equalize the data signal.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, Chabah, and Schenk, further in view of Schafhuber et al. (hereafter, referred as Schafhuber) (Adaptive prediction of time-varying channels for coded OFDM systems Schafhuber, D.; Matz, G.; Hlawatsch, F.; Acoustics, Speech, and Signal Processing, 2002. Proceedings. (ICASSP '02). IEEE International Conference on Volume 3, 13-17 May 2002 Page(s):III-2549 - III-2552 vol.3).

As to claim 6, Wang, Wiedeman, Chabah, and Schenk disclose all the subject matters claimed in claim 6, except that the measurements of the scatterer-coefficients and the equalization of the data signal is in the context of multi-carrier data transmission schemes. Schafhuber, in the same field of endeavor, teaches determining a scattering function (see page 2549, right paragraph), and therefore inherently the scatterer-coefficients, and the equalization of the data signal (see Fig. 2) in the context of multi-carrier data transmission schemes (i.e. the OFDM) (see page 2549). It would have been obvious to one of ordinary skill in the art at the time of invention to use the teachings of

Wang, Wiedeman, Chabah, and Schenk, to make the system disclosed by Schafhuber more simple and cost effective.

7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, and Chabah, further in view of Ratnarajah et al. (hereafter, referred as Ratnarajah) (US 6,757,339).

As to claim 9, Wang, Wiedeman, and Chabah disclose all the subject matters claimed in claim 1, except that a first measurement of the scatterer coefficients is implemented with the assistance of a known data sequence. Ratnarajah discloses a method for estimating the sequence of transmitted symbols in a digital communication system (see the abstract). Ratnarajah discloses that the channel impulse response coefficients (i.e. interpreted as scatterer coefficients) are determined from training symbols embedded in the transmitted data sequence (See column 1, lines 37-49). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, and Chabah as suggested by Ratnarajah, to more accurately determine the coefficients.

8. Claims 10 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, and Chabah, further in view of Smee et al. (hereafter, referred as Smee) (US 2003/0078025).

As to claim 10, Wang, Wiedeman, and Chabah disclose all the subject matters claimed in claim 1, except that the first measurement of the scatterer coefficients is implemented block-wise over an entire data sequence. Smee discloses a method (see Figs. 3 and 4) wherein the Doppler frequency (interpreted as scatterer coefficient) is

measured in operation 304 with each frame of received data (see paragraph 0052) (i.e. interpreted as block-wise). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, and Chabah as suggested by Smee to increase the performance of the equalizer.

As to claim 27, Wang, Wiedeman, and Chabah disclose all the subject matters claimed in claim 1, except that the first measurement of scatterer coefficients is implemented with unknown useful data sequences. Smee discloses that the first measurement of scatterer coefficients is implemented with unknown useful data sequences, and that default values are used in the initialization of the algorithm instead of the training and synchronization sequences (see paragraph 0052 and Fig. 3). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, and Chabah as suggested by Smee to increase the performance of the equalizer.

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, and Chabah, further in view of Kumar (US 4,959,656).

As to claim 11, Wang, Wiedeman, and Chabah disclose all the subject matters claimed in claim 1, except that a kalman algorithm is used iteratively for the measurement of the scatterer coefficients. Kumar discloses a method for detecting data and estimating the parameters of a received carrier signal (see column 4, last paragraph). Kumar further discloses that "pseudo" estimates over different bit intervals are combined by a kalman filter to provide tracking of Doppler frequency (see column 3, first paragraph). It would have been obvious to one of ordinary skill in the art at the time

of invention to modify Wang, Wiedeman, and Chabah as suggested by Kumar to improve the system due to better linearization as in iterated Kalman filtering (see column 5, lines 56-60).

10. Claims 29, 31, 33, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang and Wiedeman, further in view of Smee.

As to claim 29, Wang discloses a data signal transmitted via a time-variant channel to a receiver (see page 1443), wherein scatter coefficients including attenuation (see page 1444, left column), delay and Doppler frequency (see page 1444, right column) in the received data signal, which cause signal distortion in the channel, are measured in the receiver (see pages 1443 and 1444). Although Wang does not disclose that the signal is transmitted using a single-carrier or multi-carrier, in order to transmit the signals from transmitter to the receiver, inherently, there must be at least one carrier (single carrier). Wang discloses all the subject matters claimed in claim 29, except that the data signal is equalized with the scatterer coefficients and then demodulated with them. Wiedeman discloses a receiver apparatus comprising an equalizer and a demodulator, wherein the equalizer equalizes a Doppler frequency offset (interpreted as the first scatterer coefficient) for each correlated signal and the delay (interpreted as the second scatterer coefficient) of each of the correlated signals (see column 15, last paragraph). Wiedeman further discloses that the receiver includes circuitry for combining together all equalized correlated signals to provide a demodulator with a composite received signal (see column 15, last paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang as suggested

by Wiedeman in order to transmit the majority of the signal over the communication path (or paths) which are capable of conveying a highest quality signal (see column 16, first paragraph) and as the result increase the performance of the receiver. Wang and Wiedeman disclose all the subject matters claimed in claim 29, except that the first measurement of the scatterer coefficients is implemented block-wise over an entire data sequence. Smee discloses a method (see Figs. 3 and 4) wherein the Doppler frequency (interpreted as scatterer coefficient) is measured in operation 304 with each frame of received data (see paragraph 0052) (i.e. interpreted as block-wise). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang and Wiedeman as suggested by Smee to increase the performance of the equalizer.

As to claim 31, Wang does not expressly disclose that the measurements have been taken place in the context of single-carrier data transmission schemes. However, in order to transmit the signals from transmitter to the receiver, inherently, there must be at least one carrier (single carrier).

As to claim 33, Wang discloses a data signal transmitted via a time-variant channel to a receiver (see page 1443), wherein scatter coefficients including attenuation (see page 1444, left column), delay and Doppler frequency (see page 1444, right column) in the received data signal, which cause signal distortion in the channel, are measured in the receiver (see pages 1443 and 1444). Although Wang does not disclose that the signal is transmitted using a single-carrier or multi-carrier, in order to transmit the signals from transmitter to the receiver, inherently, there must be at least one carrier (single carrier). Wang discloses all the subject matters claimed in claim 33, except that

the data signal is equalized with the scatterer coefficients and then demodulated with them. Wiedeman discloses a receiver apparatus comprising an equalizer and a demodulator, wherein the equalizer equalizes a Doppler frequency offset (interpreted as the first scatterer coefficient) for each correlated signal and the delay (interpreted as the second scatterer coefficient) of each of the correlated signals (see column 15, last paragraph). Wiedeman further discloses that the receiver includes circuitry for combining together all equalized correlated signals to provide a demodulator with a composite received signal (see column 15, last paragraph). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang as suggested by Wiedeman in order to transmit the majority of the signal over the communication path (or paths) which are capable of conveying a highest quality signal (see column 16, first paragraph) and as the result increase the performance of the receiver. Wang and Wiedeman disclose all the subject matters claimed in claim 33, except that the first measurement of scatterer coefficients is implemented with unknown useful data sequences. Smee discloses that the first measurement of scatterer coefficients is implemented with unknown useful data sequences, and that default values are used in the initialization of the algorithm instead of the training and synchronization sequences (see paragraph 0052 and Fig. 3). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang and Wiedeman as suggested by Smee to increase the performance of the equalizer.

As to claim 35, Wang does not expressly disclose that the measurements have been taken place in the context of single-carrier data transmission schemes. However,

in order to transmit the signals from transmitter to the receiver, inherently, there must be at least one carrier (single carrier).

11. Claims 30 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, and Smee further in view of Borowski (US 3,997,841).

As to claims 30 and 34, Wang discloses that the measurement of the scatterer coefficients has been taken place in the time domain (see the abstract and page 1443, right column). Wang, Wiedeman, and Smee disclose all the subject matters claimed in claims 30 and 34, except that the equalization of the data signal takes place within the time domain. Borowski discloses that the advantages of the time-domain equalizers are that sufficient noise suppression can be achieved, which permits the use of a low-noise amplifier with sufficient control range (see column 1, paragraph 4). Therefore, for the reasons stated above, it would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, and Smee to use a time domain equalizer to equalize the data signal.

12. Claims 32 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang, Wiedeman, Smee, Borowski, and Schafhuber, further in view of Ratnarajah et al. (hereafter, referred as Ratnarajah) (US 6,757,339).

As to claims 32 and 36, Wang, Wiedeman, Smee, and Borowski disclose all the subject matters claimed in claims 32 and 36, except that the measurements of the scatterer-coefficients and the equalization of the data signal is in the context of multi-carrier data transmission schemes. Schafhuber, in the same field of endeavor, teaches determining a scattering function (see page 2549, right paragraph), and therefore

inherently the scatterer-coefficients, and the equalization of the data signal (see Fig. 2) in the context of multi-carrier data transmission schemes (i.e. the OFDM) (see page 2549). It would have been obvious to one of ordinary skill in the art at the time of invention to use the teachings of Wang, Wiedeman, Smee, and Borowski, to make the system disclosed by Schafhuber more simple and cost effective. Wang, Wiedeman, Smee, and Borowski also do not disclose that a first measurement of the scatterer coefficients is implemented with the assistance of a known data sequence. Ratnarajah discloses a method for estimating the sequence of transmitted symbols in a digital communication system (see the abstract). Ratnarajah discloses that the channel impulse response coefficients (i.e. interpreted as scatterer coefficients) are determined from training symbols embedded in the transmitted data sequence (see column 1, lines 37-49). It would have been obvious to one of ordinary skill in the art at the time of invention to modify Wang, Wiedeman, Smee, Borowski, and Schafhuber as suggested by Ratnarajah, to more accurately determine the coefficients.

Allowable Subject Matter

13. Claims 12-26 and 28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEILA MALEK whose telephone number is (571)272-8731. The examiner can normally be reached on 9AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on 571-272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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